The Prevention and Management of Asthma in Canada

A Major Challenge Now and in the Future

A Report from
The National Asthma Control Task Force

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Acknowledgements

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Preface

This report is the background document for the development of a National Asthma Prevention and Control Strategy. It has been developed with the guidance of the *National Asthma Control Task Force (NACTF)*. The Laboratory Centre for Disease Control (LCDC) of Health Canada established the NACTF in 1995 to advise on a response to the growing problem of asthma in Canada.

Any comments should be directed to the Respiratory Division, Cardio-Respiratory Diseases and Diabetes Bureau, Laboratory Centre for Disease Control, Health Canada.

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Executive Summary

Introduction

> "Asthma is a disorder of the airways characterized by paroxysmal or persistent symptoms (dyspnea, chest tightness, wheeze and cough), with variable airflow limitation [and] airway hyperresponsiveness to a variety of stimuli.
>
> Airway inflammation (including mast cells and eosinophils) or its consequences is important in the pathogenesis and persistence of asthma. This provides a strong argument for the recommendation that the management of asthma should focus on the reduction of this inflammatory state through environmental control measures and the early use of disease-modifying agents, rather than symptomatic therapy alone." (Canadian Asthma Consensus Conference, 1996)

Asthma is one of the most prevalent chronic conditions affecting Canadians. It places a heavy burden on the nation's health care expenditures, reduces productivity, and seriously affects the quality of life for individuals with asthma and their families. This report summarizes the definition, prevalence and impact of asthma, and includes a review of both the scope for prevention and control, and existing activities in Canada. It is based on current literature reviews, reports, health data, and surveys.

A National Asthma Prevention and Control Strategy can provide the overall framework for mobilizing energies from many sectors to the prevention and management of asthma in Canada. This background document will serve as the starting point for the development of the national strategy.

Summary of Research Evidence

The National Asthma Control Task Force reviewed recent surveys, epidemiologic data, and the recommendations of the 1998 Canadian consensus guidelines for asthma management. The Task Force identified the following key research findings that need to be considered in a strategy to prevent and control asthma.

Epidemiology

According to the 1996-97 National Population Health Survey, over 2.2 million Canadians have been diagnosed with asthma by a physician (12.2% of children and 6.3% of adults). An estimated 10% of children and 5% of adults have active asthma (take medication for asthma or have experienced symptoms in the past 12 months). There has been an increase in the prevalence of asthma among children in the past 15 years.

Asthma mortality rates increased from 1970 to the mid-1980s. The mortality rate changes were most evident in the 15 to 24 and the 65 and over age groups. By 1995, the mortality rates had decreased to below the 1970 level except in the 15 to 24 year age group. Hospitalization rates for asthma increased for children in the 1980s. By the mid-1990s the rate had started to decrease but remained higher than the rate in the 1970s.

Prevention

The exact cause of asthma is not known, but it appears to be the result of a complex interaction of:

a) predisposing factors (such as atopy – a greater tendency to have an allergic reaction to foreign substances);

b) causal factors, which may sensitize the airways (such as cat and other animal dander, dust mites, cockroaches, workplace contaminants); and

c) contributing factors, which may include cigarette smoke during pregnancy and childhood, respiratory infections, and indoor and outdoor air quality ("air pollution").

The increase in asthma seen among children in westernized countries in the past several decades may be the result of alterations in the nature of exposures to various factors in the fetal and early childhood period, which may, in turn, influence the development of the immune system. In genetically predisposed individuals, the altered immune system may result in an increased allergic response to foreign substances, and this may predispose the child to asthma. Vaccines that decrease the tendency to develop a hyper-reactive allergic immune response are being studied.

Research on the effectiveness of interventions to prevent asthma is lacking. Breastfeeding and avoiding the exposure of infants and young children to house dust mites, cockroaches, animal dander, and cigarette smoke may decrease the risk.

Screening

Several outstanding issues require further research before general population screening for asthma could be recommended. These include:

- determining whether earlier diagnosis and treatment would change the long-term outcome for children or adults;
- identifying and assessing the methods of screening for asthma; and
- assessing the feasibility and effectiveness of implementing a screening program.

Asthma Management

Asthma may be difficult to diagnose because of the similarity of its symptoms to other respiratory conditions. Both under- and over-diagnosis of asthma are a concern in the health care community. This is in part because no one clinical or objective diagnostic test for asthma exists. According to the Canadian Asthma Consensus Conference Guidelines for Asthma Management, the diagnosis should be based on:

a) the presence of typical symptoms that improve with asthma medication;

b) objective evidence of variable airflow limitation and/or obstruction; and

c) in some circumstances, evidence of hyperresponsiveness of the airways using a provocation challenge.

Effective co-management of asthma involving the individual and family with the health care team is dependent on:

a) **education** about asthma and its management;

b) avoidance or control of **triggers**;

c) individualized use of **medication** (controllers and relievers) given in the right way at the right time to achieve best asthma control;

d) **monitoring and follow-up**, including the assessment of symptoms, response to medication, and measurement of lung function; and

e) a personalized guided **self-management plan**.

Regular physical activity is an important component of an effective asthma management plan.

Some individuals use non-pharmacological therapy, such as acupuncture, chiropractic, herbal preparations, homeopathy, naturopathy, oligotherapy, and traditional Chinese medicine. There is a lack of sufficient research evidence at this time to either support or reject the role of these therapies in the treatment of asthma.

The control of asthma is heavily influenced by the extent to which an individual and his/her family take responsibility for its management. This includes avoiding triggers, creating a self-management plan with the health care team, adhering to the plan, and ensuring the appropriate use of health care services.

Collaborative health care teams that include the individual with asthma and the family increase the control of asthma. To ensure access to appropriate health services there must be recognition of specific needs associated with such factors as language, culture, age, gender, literacy, income, and level of education.

Parent groups and asthma voluntary organizations can facilitate the achievement of improved quality of life for individuals with asthma through education, services and support.

Given that asthma is a chronic health problem, the creation of supportive policies and the enforcement of air quality standards in school, workplace and public environments can facilitate an individual's efforts to improve quality of life and asthma control. Legislation is necessary to complement voluntary efforts to reduce exposure to air contaminants such as cigarette smoke, indoor and outdoor pollution, and workplace contaminants. Some individuals have difficulty paying for asthma medications or medication delivery devices that are essential for the control of asthma.

Scope for Improved Prevention and Management of Asthma

Combining research evidence with a review of actual practice indicates that more could be done to improve asthma prevention and management.

Primary Prevention

There is a lack of research on the effectiveness of interventions to prevent the onset of asthma. According to the epidemiological evidence, the following strategies could contribute to a reduction in the incidence of asthma. These strategies require the combined efforts of many individuals, organizations, community groups, and government. Strategies need to be directed at:

- reducing exposure in the workplace to airborne contaminants;
- reducing exposure to passive smoke, both *in utero* and among young children;
- encouraging breastfeeding and delayed introduction of solid foods;

- decreasing the exposure of young children to house dust mites, cockroaches, and moulds through regular cleaning and adequate ventilation; and
- decreasing the exposure of children who have a genetic predisposition to asthma, to known sensitizers.

Improved Management of Asthma

- Increased knowledge among physicians about clinical practice guidelines.
- Increased use of long-term inhaled anti-inflammatory controller medication to decrease the over-reliance on reliever medication.
- Increased use of objective measures of airflow for the diagnosis and serial monitoring of asthma control.
- Increased use of written, personalized asthma plan for guided self-management.
- Enhanced health services to ensure that individuals newly diagnosed with asthma and their families have access to appropriate education for asthma management. This includes not only adequate funding but also an increase in the number of appropriately trained and certified asthma educators, and in access to these educators.
- Reduction in environmental contaminants (aeroallergens, moulds, tobacco smoke, vehicle and industry emissions, noxious odours, and scents) that can trigger asthma episodes and symptoms in the home, workplace, childcare setting and schools.
- Support for those families who lack sufficient financial resources to purchase medication and devices (spacers, holding devices, mattress enclosures, and peak flow meters) for effective asthma management.

System Support Functions

- Asthma needs to be identified as a serious health problem that requires commitment from governments, the health care system, workplaces, schools, childcare settings and voluntary health organizations.
- To facilitate joint planning, communication, collaboration and advocacy, national and provincial/territorial coalitions require ongoing financial support.
- At the local level, individuals, families, health care providers from all sectors, voluntary groups, and others need to work together to ensure the availability of effective policies, services and programs.

- The need for ongoing basic, clinical, community, and epidemiological research on the prevention and control of asthma continues. Incorporating evaluations that use qualitative and quantitative methods into all programs, services, and policies would result in a large body of research data.
- The dissemination of clinical practice guidelines requires adequate funding. Effective dissemination strategies must be multi-dimensional so that they address the predisposing, enabling, and reinforcing factors that influence the service providers' adoption and use of the guidelines.
- A more detailed and timely system of monitoring trends in asthma outcome is urgently required.

Summary

Asthma is a common health problem in Canada that affects both children and adults. Reducing exposure to airborne workplace contaminants, environmental tobacco smoke, house dust mites, animal dander, and moulds may decrease the risk of the development of asthma among sensitive individuals. It may also decrease symptoms and attacks among those with asthma.

Consistent use of Asthma Practice Guidelines for diagnosis, and the use of appropriate medication, self-management plans, education, and follow-up would lead to improved asthma management in the population. The active involvement of the individual with asthma and his/her family would also ensure effective management of the condition. Their involvement requires the establishment of adequate training and funding for asthma education.

At a systems level, the asthma surveillance system is very basic. Its expansion would provide meaningful information to policy makers. An ongoing, formal process for the education of service providers on the implementation of clinical practice guidelines would not only ensure the correct and timely diagnosis of asthma, but would also provide a stronger foundation for its management. Improved collaboration at the national, provincial/territorial and regional/local levels would ensure the continuity of care, effective planning, and the optimization of the various components of the health care system toward asthma's prevention and management.

Introduction

Asthma is one of the most prevalent chronic conditions affecting Canadians. According to the 1996 National Population Health Survey,[1] asthma affects 6% of adults and 12% of children. Despite advances in medicine and technology, asthma mortality and morbidity rates in Canada and many other industrialized countries[2] rose significantly in the 1970s and 1980s. While mortality rates fell in the 1980s and 1990s, epidemiological and hospitalization data suggest that the prevalence of asthma is continuing to increase. Asthma continues to impose a heavy burden on the nation's health care expenditures, reduces productivity, and seriously affects the quality of life for individuals with asthma and their families.

Asthma is a health problem that does not have a "quick fix". It will require the combined efforts of individuals with asthma and their families, health care providers, health care institutions, schools, workplace, governments, voluntary organizations, industry, and the general public. Many individuals and organizations have been working to prevent and control asthma, but more coordination is required to eliminate duplication of effort and reduce the wide variation in the quantity, quality, and effectiveness of asthma control across the country.

This report summarizes the definition, prevalence, and impact of asthma, and examines the scope for prevention and control with a review of existing activities in Canada. It is based on an evaluation of existing literature reviews, reports, health data, and surveys.

A National Asthma Prevention and Management Strategy can provide the overall framework needed to mobilize energies from many sectors to the prevention and management of asthma in Canada. This background document is being used by the National Asthma Control Task Force to develop the national strategy.

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[1] Statistics Canada. *National Population Health Survey: Asthma Supplementary Survey*, 1996/97.
[2] World Health Organization (WHO), 13.

Definition

One of the problems that has challenged past efforts in coordinating asthma prevention and control has been the lack of a precise definition. In recent years, however, there has been agreement that inflammation of the airways plays the leading role in the consequences identified as asthma:

> "Asthma is a disorder of the airways characterized by paroxysmal or persistent symptoms (dyspnea, chest tightness, wheeze and cough), with variable airflow limitation [and] airway hyperresponsiveness to a variety of stimuli.
>
> Airway inflammation (including mast cells and eosinophils) or its consequences is important in the pathogenesis and persistence of asthma. This provides a strong argument for the recommendation that the management of asthma should focus on the reduction of this inflammatory state through environmental control measures and the early use of disease-modifying agents, rather than symptomatic therapy alone."[3]

This definition includes four concepts:

- Asthma is a chronic inflammatory disorder.
- There are typical identifiable symptoms.
- There is airflow limitation that is reversible.
- A variety of stimuli can trigger the airways' response.

The diagnosis of asthma requires assessment of the clinical symptoms, objective measurement of airway function, response to therapy and, occasionally, provocative tests. Since no single test or set of clinical variables is reliable, there will be wide variations in the frequency and accuracy of diagnoses unless all of these factors are considered.

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[3] Ernst et al, 89-100.

Prevalence of Asthma in the Population

Challenges in Determining the Scope of Asthma

Given the fundamental problems caused by an inconsistent use of clinical and objective measurements for diagnosing individuals, the population-based prevalence and severity of asthma remain difficult to estimate. Determining the scope of asthma in the population has been approached by using survey methods and administrative data sets that evaluate population-adjusted hospitalization and mortality rates.

Most epidemiological studies have used **questionnaires**, but these are limited to questions about previous physician diagnosis and the presence of symptoms suggestive of asthma. In addition, there may be people who have the condition but are not diagnosed and others who are diagnosed but who do not actually have the disease.

Despite cultural differences and the inherent difficulties described above, surveys have been valuable as one component of understanding population health. The International Study of Asthma and Allergies in Childhood (ISAAC) has provided a good start in understanding international population based asthma prevalence rates using survey methodology.[4] Studies have found good correlation between **measurement of airway hyper-responsiveness** and the ISAAC survey, further confirming that there is some promise with the use of these methods.

Canadian large-scale studies have relied on questionnaires that use a combination of physician diagnosis and typical asthma symptoms to measure prevalence rate (existing cases) in the population at a certain point in time.

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[4] Asher et al., 483-91.

Prevalence

Canada

Several recent reports provide data regarding the prevalence of asthma in Canada. Data from the 1996/97 National Population Health Survey[5] (NPHS) found the prevalence of active asthma (asthma diagnosed by a physician, and either on medication or have had symptoms in the past 12 months) was 6.2% overall: 5.0% among adults and 9.9% among children and teens (Table 1).

Table 1 Prevalence of asthma (diagnosed by a physician) by gender and age, Canada, 1996

	Active Asthma[1]			Physician Diagnosed Asthma		
Age Group	Male	Female	Total	Male	Female	Total
Children						
0-19	10.3	9.5	9.9	13.3	11.1	12.2
0-4	11.2*	-	7.3*	12.8*	-	8.2*
5-9	10.2*	9.4*	9.8	13.6*	10.7*	12.2
10-14	9.5*	10.7*	10.1	13.4	12.3*	12.8
15-19	10.6	12.3	11.4	13.3*	14.9	14.1
Adults						
20 +	3.8	6.1	5.0	5.0	7.6	6.3
20-34	4.9	7.3	6.1	6.7	9.5	8.1
35-64	2.9	5.8	4.3	3.9	7.1	5.5
65+	4.8	5.3	5.1	5.7	6.0	5.9
All Ages	5.5	7.0	6.2	7.2	8.5	7.8

[1] Physician diagnosed asthma and on medication in last 12 months or symptoms or attacks in past 12 months

\- Sample size too small to give a reliable estimate.

* High sampling variability.

Source: Statistics Canada, NPHS

[5] Statistics Canada. *National Population Health Survey*, 1996/97. (Health share file)

Millar and Hill reported that the prevalence of asthma among children aged 0 to 14 years increased from 2.5% to 11.2 % between 1978 and 1995.[6] In a 1994 study Hessel found that nearly 13% of children had been diagnosed with asthma at some time in the past.[7] A study of children in sentinel health unit regions in Canada reported the same figure (13.0%) for children up to 19 years of age who had been diagnosed by a physician and had experienced an asthma attack, had had wheezing or whistling in the chest, or were taking asthma medication.[8] Rates of diagnosis of asthma are higher among boys.[9,10]

International Statistics

A 1998 report from the United States Department of Health and Human Services reported a sharp increase in the rate of self-reported asthma among all age groups between the years 1980 and 1994, from 30.7 to 53.8 per 1,000 (3.1% to 5.4%). Among children aged 5 to 14 years, the figures rose from 42.8 to 74.4 per 1,000 (4.3% to 7.4%), and from 22.2 to 57.8 per 1,000 (2.2% to 5.8%) among children aged 0 to 5 years.[11]

In a review of international statistics, the World Health Organization (WHO) reported that the prevalence of current asthma in children varies from 0% in Papua New Guinea and the Australian indigenous population to 11.1% in New Zealand.[12]

Reasons for Increase in Prevalence of Asthma Over Time

The increase in asthma seen among children in westernized countries in the past several decades may be a result of alterations in the nature of exposures to various factors in the fetal and early childhood period that may influence the development of the immune system. In genetically predisposed individuals, the altered immune system may result in an increased allergic response to foreign substances and in this way predispose the child to asthma. Vaccines that decrease the tendency to develop a hyper-reactive allergic immune response are being studied. Possible factors in the increased prevalence are:[13-15]

- changes in housing with greater exposure to indoor aeroallergens, such as cats, house dust mites, cockroaches, and moulds;

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[6] Millar et al, 12.
[7] Hessel et al, 398.
[8] Health Canada, 26.
[9] Ibid.
[10] Hessel, 398.
[11] United States Department of Health and Human Services: Centers for Disease Control and Prevention. Surveillance for Asthma - United States, 1960-1995, 2.
[12] WHO, 12.
[13] Sears, SII2-3.
[14] Brown et al, 198.
[15] Millar et al, 17.

- environmental factors, such as indoor air quality due to changes in ventilation and building practices, and outdoor air pollution;
- changes in diet;
- impact of early childhood infections and their treatment; and
- a possibly greater awareness of the illness that may have led more people to be tested and diagnosed.

Age at Onset

Among children, the onset of asthma, whether defined by the sign of first symptoms or actual diagnosis, is often before the age of 5 or 6. In a study of children up to grade six, Hessel found that 20.2% of children were diagnosed before the age of 1, over one-half (57.4%) before the age of 4 and 67.4% before reaching 5 years of age.[16] A study of students up to the age of 19, found a diagnosis rate of 8.5% before the age of 1 and 40.3% before the age of 5, and "first symptoms" rate of 15.3% at age 1 and 48.5% by age 5.[17]

The early age of onset of asthma for many children is a challenge to both families and health care providers. Children may not be able to indicate when they are developing symptoms, and administering medication can be difficult.

Table 2 Age at onset of asthma

	Age	Hessel Sample: Students to Grade 6 Cumulative %	Student Lung Health Survey Sample: Students to Age 19 Cumulative %
Age at first diagnosis	< 1 year	20.2	8.5
	< 4 years	57.4	
	< 5 years	67.4	40.3
Age at first symptoms	< 1 year		15.3
	< 5 years		48.5

[16] Hessel et al, 398-9.
[17] Health Canada, 34.

Associated Morbidity and Mortality

Asthma Symptoms and Attacks

An asthma attack can be a frightening event with feelings of suffocation, breathlessness, and loss of control. According to the National Population Health Survey (NPHS) - Asthma Supplement, 56% of individuals with active asthma have had an asthma attack in the past 12 months. Of those who have had an attack in the past year, 14% stated they continuously have symptoms, and 42% often have symptoms. Among those who have not had an attack, 12% continuously have symptoms and 31% often have symptoms. Poor asthma control often results in time away from school, work, sports, or other activities that affect the quality of life. Even if the individual with asthma is able to attend work or school, ongoing symptoms or medication side effects may alter concentration and performance.

Even between asthma attacks, asthma takes its toll. One-quarter (25.7%) of children aged 2 to 19 years experience symptoms continuously or often.[18] Sleep disturbances due to asthma occur from 4 to 12 times per year for a similar proportion (26.6%) of children with asthma.[19]

Visits to Physicians

Asthma is the catalyst for a great number of visits to physicians in a year. In fact, the NPHS Asthma Supplement Survey reports that in 1996-97 44.2% of Canadian children with asthma went to their doctors as many as three times, and another 15.4% went four or more times.[20] Of those who visited a doctor during the twelve months preceding the survey, over three-quarters (76.0%) visited the family doctor: 40.0% went to a pediatrician, 26.9% to an emergency room, and 10.4% to a lung doctor or allergist. These figures indicate not only the seriousness of the problem but also the extent of asthma's expense to the health care system.

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[18] Statistics Canada. *National Population Health Survey: Asthma Supplementary Survey*, 1996/97.
[19] Ibid.
[20] Ibid.

Emergency Visits

Visits to emergency rooms may be a sign of poorly controlled asthma. The NPHS Asthma Supplement survey found that 18% of individuals with active asthma had visited the emergency department at least once in the past year.[21]

Hospitalizations

The number of hospitalizations due to asthma may be a more serious sign of poor disease control. According to the NPHS Asthma Supplement, 5.3% of those diagnosed with asthma in Canada require hospitalization each year.[22]

Routine national hospital statistics record the number of times people come into hospital with a diagnosis of asthma (hospital separations). Unfortunately, one cannot tell whether this was one person admitted 10 times or 10 people admitted once. Although these data cannot be used to accurately determine the rate of hospitalization among individuals with asthma, they give some indication of the degree of control of asthma in the community.

Overall, hospital separations for asthma increased from 1970 to the late 1980s and then decreased (Figures 1, 2, and 3). While the rate of hospital separations among children for asthma has dropped considerably since 1978/79 (12,215 to 4,326 per 100,000 in 1995), asthma remained the leading cause of hospitalization of children aged 1 to 4 years.[23] For older children it ranked second or third, depending on gender.

The more recent decline in the asthma hospitalization rate may reflect improved disease control. However, downsizing in the hospital sector with reduced availability of beds may also be influencing some of the observed changes. This latter explanation is supported by the continued decrease in the age-adjusted rates of hospital days for asthma since the 1980s (Figures 4, 5, and 6).

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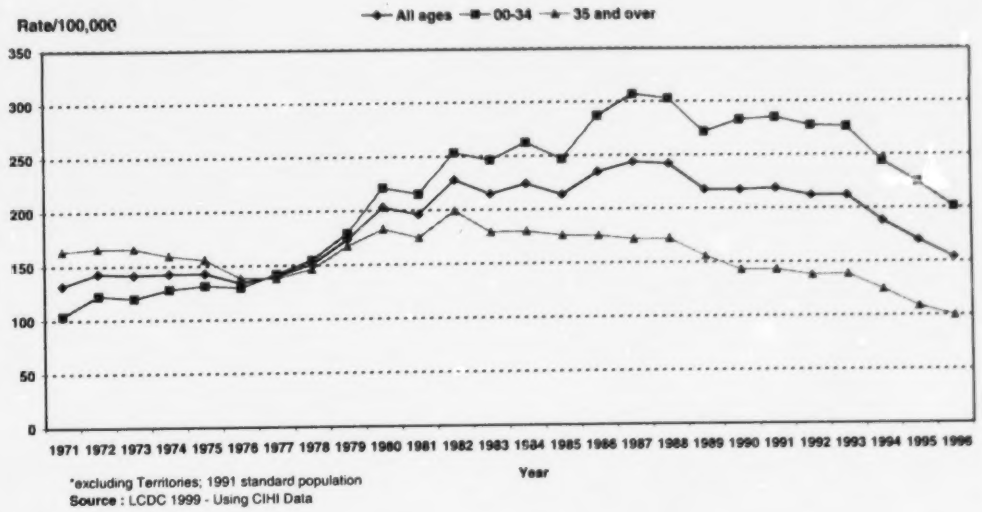
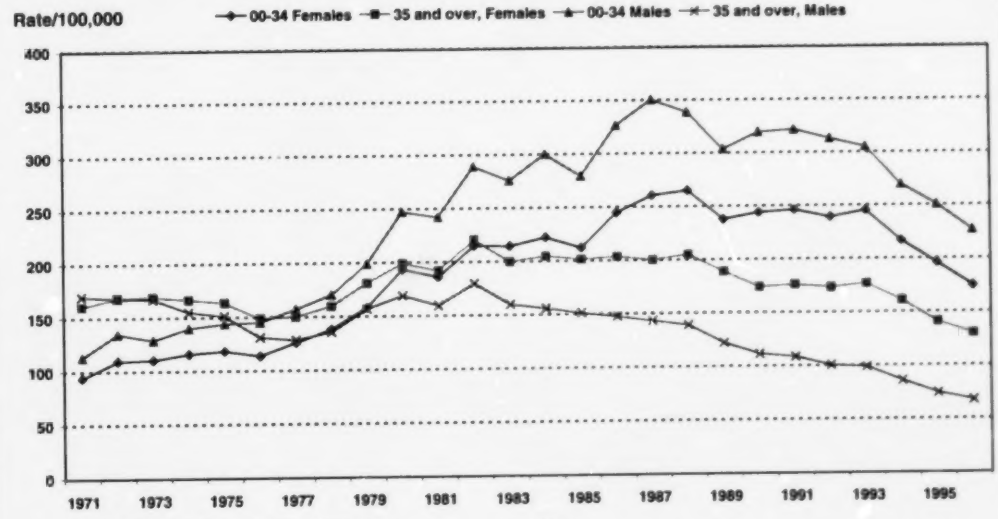
[21] Ibid.
[22] Ibid.
[23] Millar et al, 12.

Figure 1 **Age-adjusted rates of hospital separations/100,000 for asthma - both genders - Canada* , 1971-1996.**



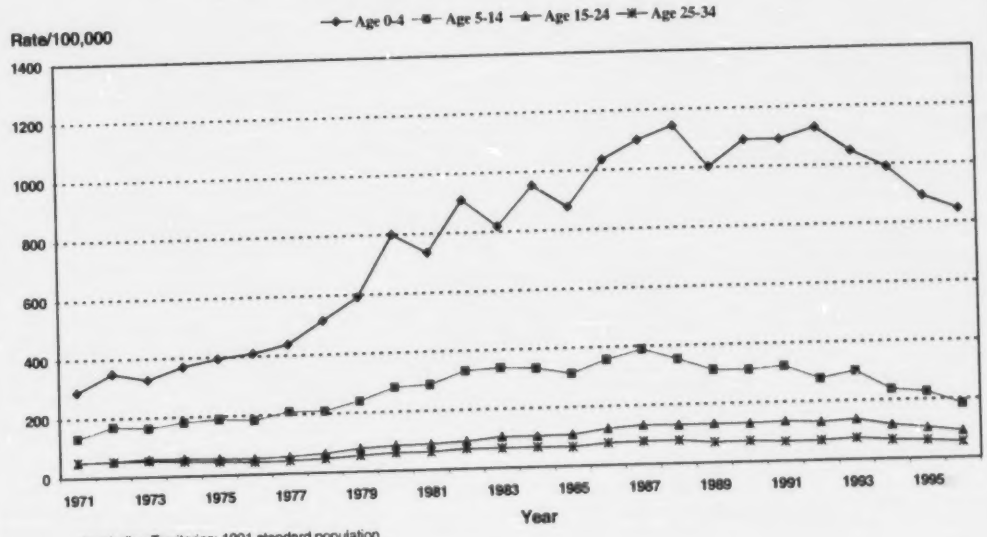
*excluding Territories; 1991 standard population
Source : LCDC 1999 - Using CIHI Data

Figure 2 **Age-adjusted rates of hospital separations/100,000 for asthma - by age group and gender - Canada* , 1971-1996.**



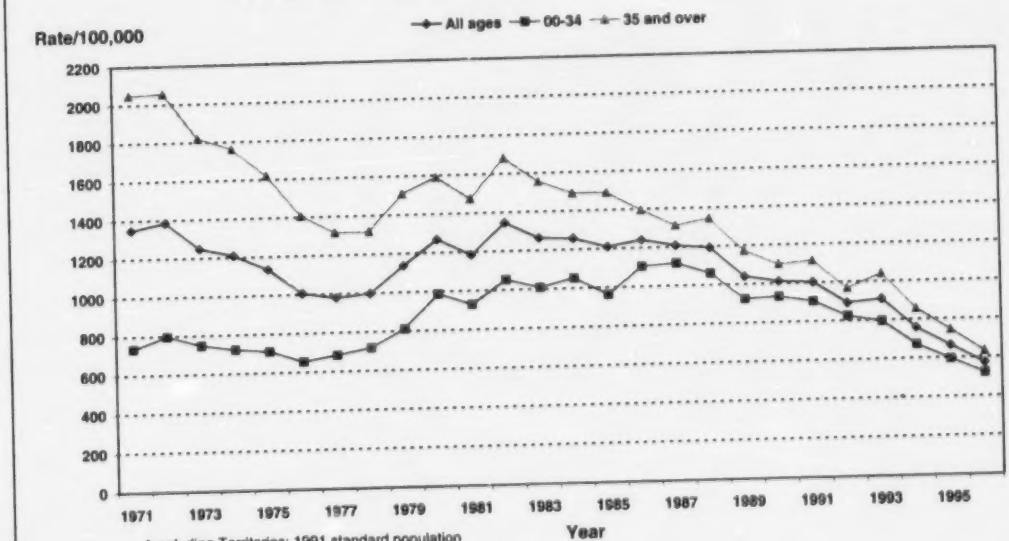
*excluding Territories; 1991 standard population
Source : LCDC 1999 - Using CIHI Data

Figure 3 **Age-adjusted rates of hospital separations/100,000 for asthma in the younger age groups - both genders - Canada*, 1971-1996.**



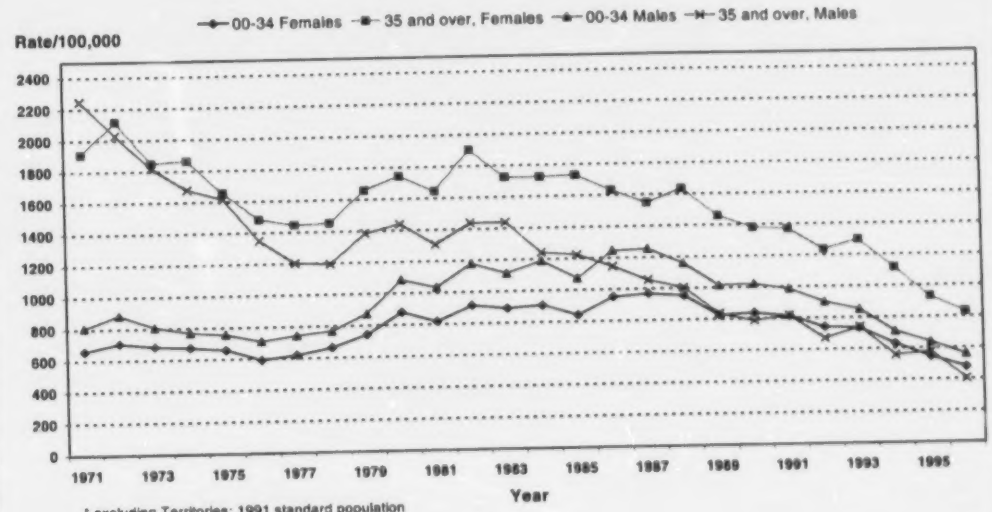
*excluding Territories; 1991 standard population
Source: LCDC 1999 - Using CIHI Data

Figure 4 **Age-adjusted rates of hospital days/100,000 for asthma - both genders - Canada* , 1971-1996.**



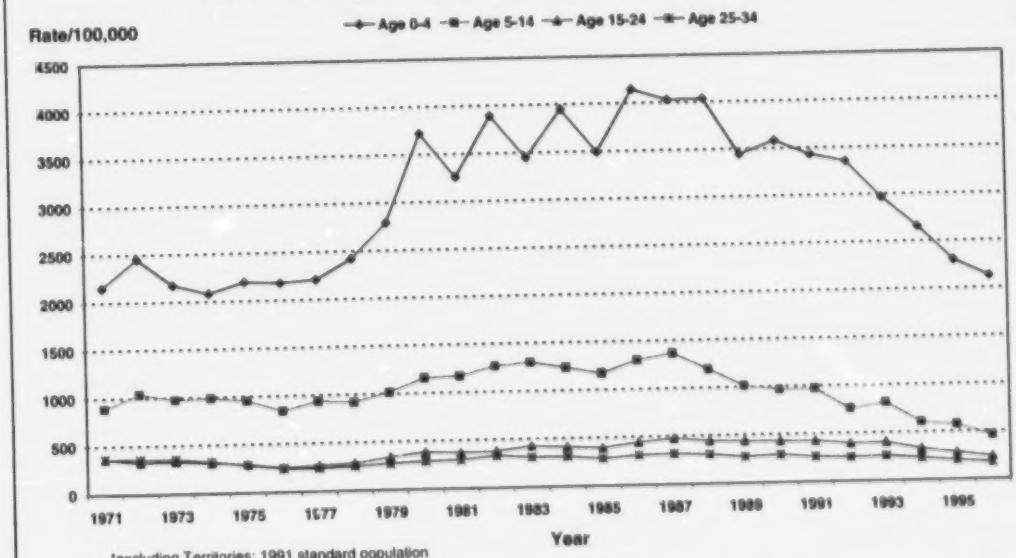
*excluding Territories; 1991 standard population
Source: LCDC 1999 - Using CIHI Data

Figure 5 **Age-adjusted rates of hospital days/100,000 for asthma - by age group and gender - Canada*, 1971-1996.**



* excluding Territories; 1991 standard population
Source: LCDC 1999 - Using CIHI Data

Figure 6 **Age-adjusted rates of hospital days/100,000 for asthma in the younger age groups - both genders - Canada*, 1971-1996.**



*excluding Territories; 1991 standard population
Source: LCDC 1999 - Using CIHI Data

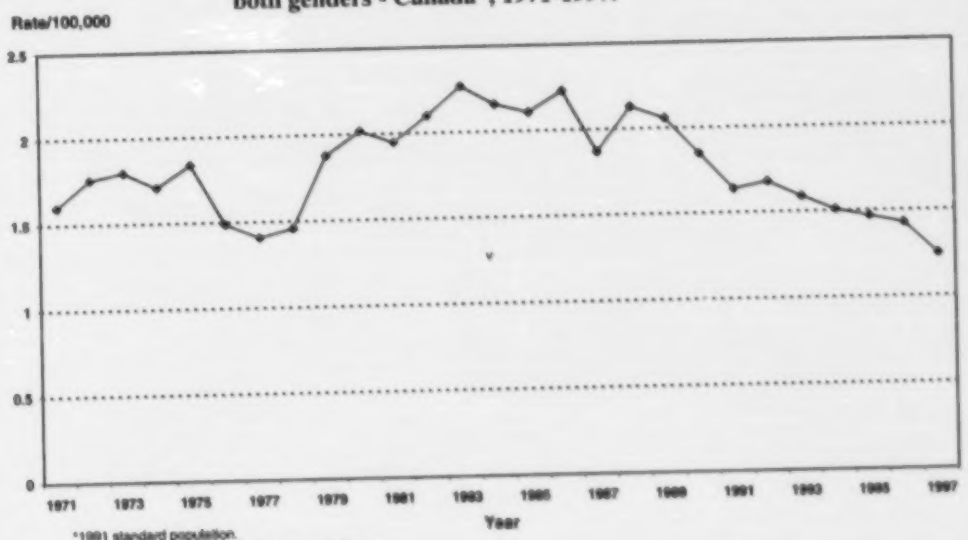
Deaths

Overall, asthma mortality rates increased in the 1980s but have since decreased (Figure 7). The increase and then decrease in mortality rates was mostly in the 15 to 24 and the over-65 age groups (Figures 8 and 9).

The failure to decrease asthma mortality even further may be because:

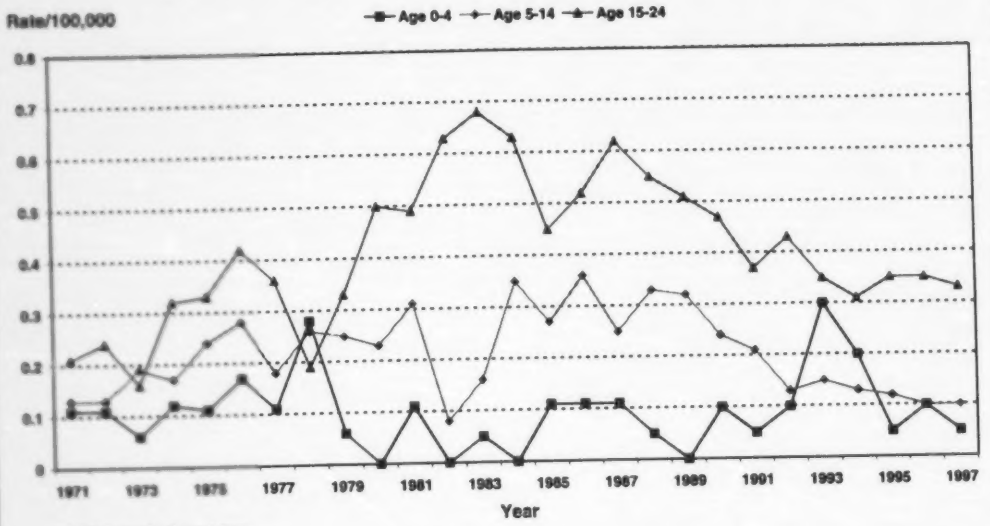
- young persons may fail to exercise proper control over their asthma through non-compliance with their medications; or
- the individual with asthma or health care providers may not fully understand or appreciate the severity of an asthma attack and its consequences.

Figure 7 **Age-adjusted asthma mortality rates/100,000 - all ages - both genders - Canada*, 1971-1997.**



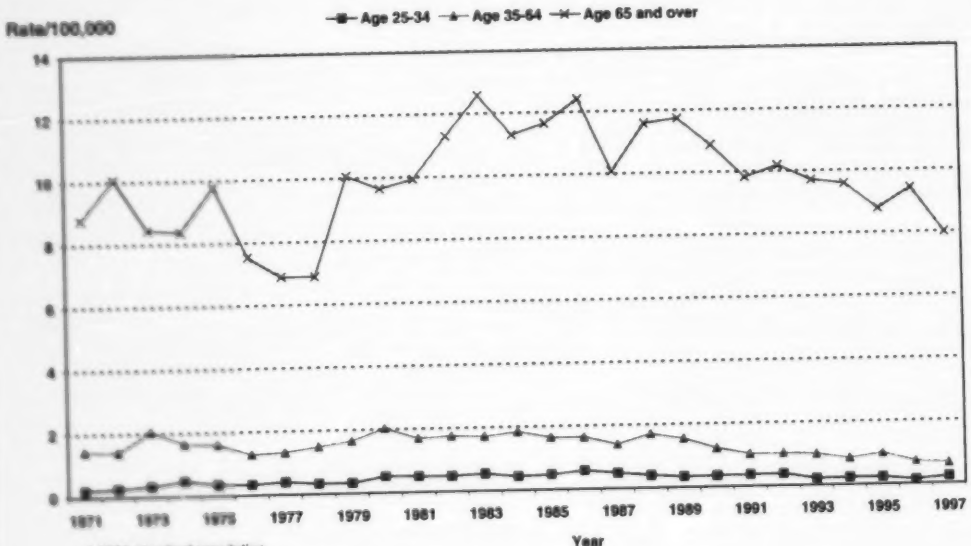
*1991 standard population.
Source: LCDC - Using Statistics Canada Data

Figure 8 **Age-adjusted asthma mortality rates/100,000 - ages 0-24 - both genders - Canada*, 1971-1997.**



* 1991 standard population.
Source: LCDC 1999 - Using Statistics Canada Data

Figure 9 **Age-adjusted asthma mortality rates/100,000 - ages 25 and over - both genders - Canada*, 1971-1997.**

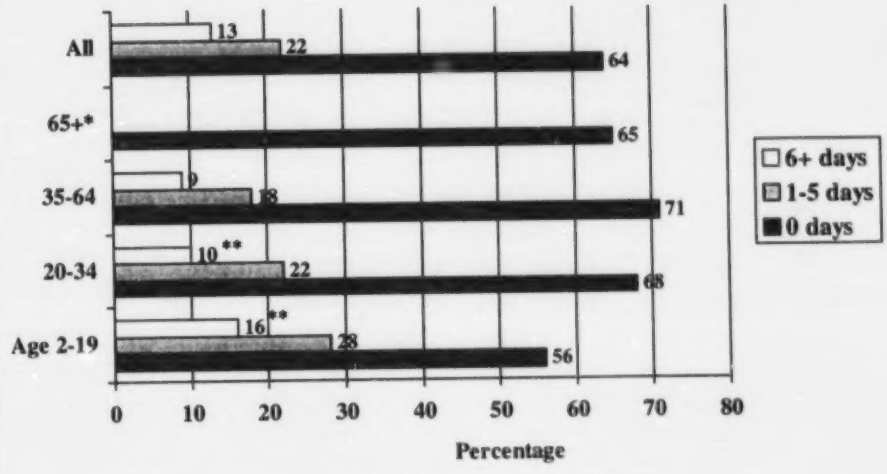


* 1991 standard population
Source: LCDC 1999 - Using Statistics Canada Data

Personal, Social and Economic Impact

According to the 1996-97 NPHS Asthma Supplement, 35% of individuals with current asthma have been restricted in their daily activities by asthma – 22% for one to five days and 13% for more than five days in the previous year. (Figure 10).

Figure 10 Proportion of individuals diagnosed with active asthma who had activity restriction in past year - Canada, 1996-97.



Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*

** too small* *** high sampling variability*

Over one-quarter (28%) of children with asthma report having to limit their normal activities for from one to five days in a 12-month period; an additional 16% have had to do so for six or more days.[24] According to the Student Lung Health Survey, these limitations include both the type and amount of play and other activities, and attendance at school.[25]

Among adults, having asthma affects their work and can cause financial limitations and worry. Whether those with asthma are children or adults, the limitations imposed by their asthma also have implications on the quality of life for their families.

The economic costs associated with asthma are both direct and indirect.

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[24] Statistics Canada. *National Population Health Survey: Asthma Supplementary Survey*, 1996/97.
[25] Health Canada, 45.

Table 3 Economic costs associated with asthma

Direct Costs	Indirect Costs
Inpatient care Emergency services Health care provider services Ambulance use Drugs and devices Outpatient diagnostic tests Research and education	Productivity costs due to: • Absence from work • Inability to perform housekeeping activities • Need to care for children with asthma who were absent from school • Time spent travelling and waiting for medical care • Premature death

In 1990, the total cost was estimated to be between $504 million and $648 million, $306 million of which was attributed to direct costs, including $124 million spent on drugs. Illness-related disability was the largest component of indirect costs ($76 million).[26]

[26] Krahn et al, 821.

Causes of Asthma

Risk Factors

The 1995 WHO report "Global Strategy for Asthma Management and Prevention" summarizes the research regarding causes of asthma.[27] The exact cause of asthma is not known, but it appears to be the result of a complex interaction of:

- **predisposing factors**, including atopy - a greater than usual reaction to foreign substances;
- **causal factors** that sensitize the airways, such as inhaled allergens in the home and outside environment as well as in the workplace; and
- **contributing factors** that increase the likelihood of a person developing asthma when exposed to a causal factor, or that may increase a person's susceptibility to asthma.

Once an individual has asthma a variety of triggers (specific to each person) will exacerbate or cause symptoms.

Several risk factors that appear to be involved in the development of asthma have been identified.

Predisposing Factors

Atopy - Atopy is the body's propensity to produce abnormal amounts of IgE in response to environmental allergens. It appears to be the strongest identifiable predisposing factor for asthma.

Gender - Young boys appear to develop asthma more often than young girls, probably as a result of their smaller airways. This imbalance reverses with age: more adult women than men develop asthma.

Genetics - Asthma (and other allergic conditions such as eczema and allergic rhinitis) are more common in families where at least one parent has asthma. The link is stronger if it is the mother who has asthma. The relationship to parental allergies follows a similar, but weaker, pattern.

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[27] WHO, 26-32.

Causal Factors

Indoor allergens - exposure to house dust (domestic mites), animal danders (pets), cockroach allergen, and fungi

Outdoor allergens - pollens and fungi

Occupational sensitizers - exposure to work-related agents. This is the only documented cause of asthma in adults.

Contributing Factors

Respiratory infections - Viral respiratory infections early in life do not cause asthma but can be an exacerbating factor.

Air pollution - Air pollution does not appear to cause asthma but may trigger an asthma attack. Outdoor pollutants include industrial and photochemical smog. Indoor pollutants come from cooking and heating sources, as well as materials used in building construction and furnishings.

Smoking - Smoking produces a mixture of over 4,500 compounds and contaminants, including gases, vapours, and particulate matter. Passive smoking or the inhalation of second hand smoke is especially irritating to the respiratory system, and contributes to respiratory morbidity in children under two years of age. Exposure of the fetus, infant and young child to tobacco smoke increases the risk of asthma. Active smoking, when combined with occupational sensitizers, increases the risk of developing asthma.

Low income – Asthma is more prevalent among low-income adults over 35 years of age.[28]

Biological Mechanism

Asthma is a condition that affects the airways in the lungs. The bronchial tubes of a person with asthma have a "twitchiness" or increased sensitivity when exposed to triggers. Once triggered, this sensitivity causes the airways to narrow in two ways:

- The muscles in the walls of the bronchial tubes tighten and go into spasms.
- The inner lining of the bronchial tubes becomes inflamed, causing swelling, congestion (contraction of the smooth muscle in the airways), and excessive production of mucus.

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[28] Erzen et al, 1060-65.

"The recent association found between serum IgE levels and indices of asthma in all age groups, including individuals who are nonatopic, raises the possibility that all forms of this disorder relate to a mucosal inflammatory response initiated by environmental or other antigens." [29]

The inflammation most often brings on the symptoms of wheezing, cough, chest tightness, or breathlessness. Occasionally, the symptoms become so severe as to interfere with normal activities, such as exercise, sleep and speech.

Asthma Triggers

Triggers are factors that exacerbate asthma. They include additional exposures to causal factors that have already sensitized a person's airways, such as allergens, respiratory infections, exercise and hyperventilation, weather changes, outdoor and indoor pollutants, foods, additives, and drugs. Each person's triggers differ from another's and may also vary over time.

Two recent studies provide data on the common asthma triggers for Canadians (Table 4). Colds or chest infections are the predominant triggers among all age groups, followed by exercise or sports, tobacco smoke and allergens such as pollen, flowers, and grass.

In the two studies, the various triggers fall in a similar rank order. The greatest discrepancies lie in the proportions related to dampness or humidity, air pollution, and stress. Part of this difference may be attributable to the fact that dampness and humidity was only included in the "other" category of the Student Lung Health Survey (SHLS).

There is a difference in the reported triggers among the various age groups (Table 5). Common triggers in children are infections and exercise. Inhaled allergens and infections are common in the 35 to 64 year age group.

Many people (64%) report that passive smoke is a trigger for an attack. Nearly half (43.7%) of all children aged 2 to 19 years with asthma were exposed to passive smoke on a regular basis (primarily in the home and car).[30]

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[29] WHO, 59.
[30] Statistics Canada. *National Population Health Survey: Asthma Supplementary Survey*, 1996/97.

Table 4 Common asthma triggers, Canada, 1995-97

Trigger	National Population Health Survey (NPHS) 1996-97[31] % *	Student Lung Health Survey (SHLS) 1995-1996[32] %**
Colds or chest infections	80.4	86.4
Exercise or sports	64.7	75.0
Tobacco smoke	64.1	55.2
Pollen, flowers, grass	60.4	58.4
Dust	59.8	54.5
Cold air	59.1	53.0
Dampness or humidity	57.2	3.8
Animals	51.9	47.0
Air pollution	48.1	31.7
Stress	47.7	28.6
Mould or mildew	44.5	33.2
Temperature change	41.9	
Feathers	34.2	26.5
Perfumes	32.6	
Fumes from wood heating	30.5	25.5
Certain foods	17.9	13.4
Certain medicines	9.8	7.0

* % of all age groups with active asthma (diagnosed by a health practitioner, and had taken medication or had symptoms in last 12 months).

** % of students (5-19) with active asthma (diagnosed by a health practitioner and met any of the following three criteria in the previous 12 months: had had wheezing or whistling in the chest; had had an asthma attack; had taken asthma medicine).

[31] Statistics Canada. Ibid.
[32] Health Canada, 36.

Table 5 Proportion of those diagnosed with active asthma who have specific asthma triggers by age group, Canada, 1996-97

	2-19 years	20-34 years	35-64 years	65+ years	Total
Inhaled allergens					
Dust	47%	70%	70%	54%	60%
Feathers	29	39	37	34	34
Mould	38	44	56	37	44
Animals	48	62	54	34	52
Pollen	54	67	67	49	60
Perfumes	21	31	46	41	33
Fumes from wood stove	24	25	41	35	30
Air pollution	38	50	57	58	48
Tobacco smoke	55	67	70	73	64
Air characteristics					
Dampness & humidity	52	56	63	61	57
Change in temperature	42	35	46	45	42
Cold air	47	64	68	71	59
Infection					
Colds	84	81	76	78	80
Exercise					
Exercise	68	72	58	54	65
Ingested allergens					
Food	14*	15	25	too small	18
Medicines	9*	8*	12	too small	10
Emotions					
Emotions	40	47	57	54	48

Source: *Statistics Canada, NPHS - Asthma Supplement*

** High sampling variability*

Scope for Prevention

Asthma is caused primarily by environmental factors that, by their nature, are largely preventable. Historically, more emphasis has been placed on treatment of the condition than prevention. It is believed that significant progress could be made toward controlling the incidence of asthma by reducing exposure to environmental factors.[33]

Some environmental manipulations may apply only to high-risk infants; other primary prevention measures would be of benefit to all.

Table 6 Environmental factors and prevention measures

Factor	Comment	Prevention Measure
Indoor allergens	Reducing exposure can be especially beneficial to infants.	Decrease exposure to indoor allergens such as domestic mites by • creating dust free homes - eliminating carpets, curtains, and other dust collectors; using mattress/pillow covers; • improving ventilation and decreasing humidity; and • regular cleaning.
Tobacco smoking	Reducing exposure can be especially beneficial to infants and young children.	Decrease exposure of fetus and infants to passive smoke.
Outdoor pollutants	Outdoor pollutants affect all age groups.	Decrease level of motor vehicle emissions. Decrease airborne commercial and industrial pollutants.
Workplace environments	Agents in the workplace can sensitize airways in workers.	Prevent exposure of workers to harmful workplace agents. Prevent sensitization by adequate occupational hygiene measures.
Respiratory infections	Viral respiratory infections, especially in infants and young children, may predispose them to asthma.	Prevent respiratory infections among young children by • promoting good nutrition; • avoiding overcrowding at day-care; and • instituting infection control in day care settings.
Nutrition and diet	Breastfeeding and delayed introduction of solid food may reduce the incidence of asthma.	Encourage breastfeeding among new mothers with maintenance for at least six months.

[33] WHO, 64-67.

Prevention and Control Activities in Canada

There are many health professionals, community organizations, voluntary organizations, professional societies, community groups, and governments that are working to reduce the factors associated with the onset of asthma.

Tobacco Smoke

Many individuals, organizations, and governments are endeavouring to prevent young people from starting to smoke, to help people stop smoking, and to decrease exposure to passive smoke. Some interventions, such as prenatal and school education programs, are directed at the individual while others focus on the environment within which people live. Examples of the latter include bylaws restricting smoking in schools and public places, monitoring tobacco sales to minors to reduce access to cigarettes, creating limits to cigarette packaging and reductions in tobacco advertising, and raising prices through taxation on cigarettes. This work needs to be expanded to reduce the continued high prevalence of smoking and exposure to passive smoke in Canada.

Prevention of Infection

It is difficult to prevent respiratory infections among children other than those for which a vaccine has been developed. Children in group childcare settings have higher rates of infection because they are in close proximity to so many other children. Therefore, it is important to emphasize infection control in these settings. In the future, immunization for respiratory syncitial virus (RSV) may be a useful prevention strategy.

Indoor Air Quality

People spend a great amount of time indoors. Changes to building construction in the last several years have greatly reduced fresh air circulation in indoor environments. This applies to houses, apartments, schools and the workplace. As a result, people are exposed to higher levels of aeroallergens (pets, house dust mites, cockroaches, moulds), chemical contaminants, and irritants. Building codes could be changed to increase fresh air circulation and improve the quality of air. Social marketing programs are needed to educate the public about the relationship between the indoor environment and asthma.

Outdoor Air Quality

Legislation to reduce automobile emissions and other industry pollutants would further decrease present levels of contaminants in the outdoor air. Stricter regulations and enforcement strategies are needed.

Infant Feeding

Many programs provide education and create a supportive environment to promote breastfeeding. Further work needs to be done with single and low-income women, whose rate of breastfeeding is lower than that of other women in the population.

Summary

Epidemiological studies suggest that the following factors may be causally related to the onset of asthma or be contributing factors:

- aeroallergens (pets, house dust mites, cockroaches, moulds);
- tobacco smoke;
- workplace pollutants;
- outdoor pollutants; and
- respiratory infections.

There is a lack of research on the effectiveness of interventions to prevent the onset of asthma. According to the epidemiological evidence, it is likely that the following strategies will contribute to a reduction in the incidence of asthma. These strategies require the combined efforts of many individuals, organizations, community groups, and government. Strategies need to be directed at:

- reducing exposure in the workplace to airborne contaminants;
- reducing exposure to passive smoke, both *in utero* and among young children;
- encouraging breastfeeding and delayed introduction of solid foods;
- decreasing the exposure of young children to house dust mites, cockroaches and moulds through regular cleaning and adequate ventilation; and
- decreasing the exposure of children with genetic predisposition to asthma to known sensitizers.

Screening for Asthma/Early Detection

Rationale

According to Last's *Dictionary of Epidemiology* "Screening tests sort out apparently well persons who probably have a disease from those who probably do not. A screening test is not intended to be diagnostic. Persons with positive or suspicious findings must be referred to their physician for diagnosis and necessary treatment".[34] When screening is done by a clinician as part of clinical care the term "case finding" is often used.[35]

A screening test can be correct or it can produce false positives (the test is positive, but the person does not really have asthma) or false negatives (the test is negative but the person really does have asthma). As a result, it is critical that:

- high quality tests be used;
- they be performed by well trained personnel; and
- the screening program be part of a larger program with links to diagnosis and treatment.

A screening process for the detection of asthma in children should ensure that the diagnosis is timely, accurate and reliable. The identification of the disease and its severity must be associated with an intervention strategy that reduces morbidity and mortality and improves the quality of life.

Screening Principles Applied to Asthma

Jones has outlined J.M.G. Wilson's general principles of screening with reference to asthma.[36] The following table summarizes this paper.

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[34] Last, 152-153.
[35] Riegelman et al, 29
[36] Jones, 180.

Table 7 Screening principles applied to asthma

General Principles of Screening	Current Status Re Asthma in Canada
1. The condition should be an important health problem.	Approximately 10% of Canadian children are afflicted with the condition.
2. There should be accepted treatment that improves health outcome.	Although there are effective treatments for asthma, it is not known if earlier diagnosis makes a difference in long-term outcome.
3. Facilities for diagnosis and treatment should be available.	Most asthma can be treated in the primary care setting that is available to everyone.
4. There should be a recognizable or early symptomatic stage.	There are characteristic symptoms of asthma and lung function changes in the early stages.
5. There should be a suitable and acceptable test for examinations.	There is no simple reliable test that can be used in a screening program. There are, however, several screening procedures that can guide further clinical investigation. Given the difficulty of making the diagnosis in mild cases of asthma, there is a danger that a screening program could label children as asthmatic when they do not have this condition.
6. The natural history of the disease should be adequately understood.	Currently, knowledge of asthma evolution is incomplete.
7. There should be an agreed policy on whom to treat.	Management guidelines are applicable to recognized asthma but have not been developed for screening programs.
8. The cost of case-finding (including diagnosis and treatment) should be economically balanced in relation to possible expenditure in medical care as a whole.	Diagnosing asthma by non-invasive means (questionnaire or study of patients' notes) is inexpensive and could be included as part of periodic health exams.
9. Case finding should be a continuous process.	The primary care setting and well child and periodic health exams could be used as the opportunity for screening.

Summary

At the present time, there is no organized approach to screening for asthma in Canada. Screening could potentially contribute to an asthma prevention and control program. However there are several outstanding issues that must be resolved before screening is recommended:

- Does earlier diagnosis and treatment make a difference in long-term outcome for children or adults?
- What screening tests should be used? How should the results be interpreted to identify individuals who need further assessment?
- How could a screening program be implemented?

Scope for Control of Asthma

Asthma is a chronic disease that can have a major impact on the quality of life of an individual and his/her family. The goals of a successful asthma management program[37] are to:

Reduce Symptoms

- Achieve and maintain control of symptoms
- Prevent asthma exacerbations
- Prevent asthma mortality

Protect Pulmonary Function

- Maintain pulmonary function as close to normal levels as possible
- Prevent development of irreversible airflow limitations

Improve Quality of Life

- Maintain normal activity levels, including exercise
- Avoid adverse effects of asthma medications

The effective management of asthma requires a partnership between the health care team, the individual with asthma, and his/her family. It also requires the creation of a supportive environment in the workplace, daycare, school and public places to assist the individual with asthma in avoiding triggers that are beyond his/her control. A supportive environment also allows the individual and family to make the adjustments required to maximize their quality of life.

The management of asthma at the individual level starts with confirmation of the diagnosis and the level of asthma severity. From there, an asthma management plan is developed that includes:

- **education** about asthma and its management;
- identification, avoidance, or control of **triggers**;
- individualized use of **medication** (controllers and relievers) given in the right way at the right time to achieve best asthma control;
- **monitoring and follow-up**, including the assessment of symptoms, response to medication, and measurement of lung function; and
- a guided self-management plan.

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[37] WHO.

Clinical practice guidelines for the management of asthma were first developed in 1996 and then revised in 1998 at the Canadian Asthma Consensus Conference.[38] This conference was a joint initiative of the Canadian Thoracic Society, Canadian Paediatric Society, Canadian Society of Allergy and Clinical Immunology, Canadian Association of Emergency Physicians, and the Family Physicians Asthma Group of Canada. These organizations, along with the Lung Association and the College of Family Physicians of Canada, sponsored the event. The research literature was reviewed and synthesized into recommendations. Experts in each area reviewed these recommendations.

The recommendations from the Consensus Conference detail the action that should be taken in the clinical setting to improve the control of asthma. They form the basis of a national strategy to prevent and control asthma.

A survey was conducted in 1996-97 to assess asthma management practices in Canada among five physician specialty groups: pediatrics, internal medicine, respirology, allergy/clinical immunology, and general practice/family medicine.[39] The questionnaire was sent to 4,489 physicians in the 10 provinces and territories, and the response rate was 52%. This survey provides information on current asthma practices among physicians

Diagnosis

Consensus Conference Recommendations

There is no one definitive test that can be used to diagnose asthma, and this requires a clinician to piece together several sources of information in order to reach such a diagnosis. As understanding of the underlying causes of asthma increases, more specific tests are being developed. At the present time, the diagnosis of asthma is based on:

- presence of typical symptoms and an improvement in symptoms with asthma medication;
- evidence of variable airflow limitation and/or obstruction; and
- in some circumstances, evidence of hyper-responsiveness of the airways using a provocation challenge.

[38] Canadian Asthma Consensus Group, S1-S62.
[39] Price Waterhouse.

Canadian Situation

Unless clinical practice guidelines are followed, the danger of both under- and over-diagnosis exists.[40,41] This is not surprising given the lack of specificity of the symptoms. Health care providers may diagnose the symptoms as some other problem, such as bronchitis. In addition, individuals with asthma symptoms may not come to be assessed by their primary care provider

The interpretation and availability of tests to assess variable airway obstruction is inconsistent. Because of the variable nature of the disease over time, the tests for airway obstruction and hyper-responsiveness may not reveal a problem even when asthma exists.

An assessment of the peak expiratory flow (PEF) can be easily done in the office setting. It is essential that the meter be used properly and repeated measurements taken to assess variability of the individual with asthma over time. The health care provider must instruct the individual carefully and know how to interpret the findings. One advantage of this assessment tool is that it can be used at home. This technology is probably under-used.

According to the survey of physicians,[42] there was variation among the type of physicians in the use of spirometry to assist in the diagnosis of asthma among adults - respirologists (98%), internists (81%), family physicians (43%), pediatricians (31%) and immunologists/allergists (71%). Knowledge of practice guidelines and more recent graduation were associated with greater use of spirometry.

There was also great variation in the use of other diagnostic procedures among the physician groups. Family physicians frequently (75%) used a trial course of an inhaled short acting bronchodilator at home. Respirologists also used a response to an inhaled short acting bronchodilator, but this was more often done in the office or laboratory (85%).

Airway hyper-responsiveness is usually assessed with a bronchial provocation challenge. This test is only available in specialized centres. There is some risk with the test of a severe reaction; therefore, it should only be used by experts and only after other simpler diagnostic tests have been done.

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[40] WHO.
[41] Dzyngel et al, 291-300.
[42] Price Waterhouse.

Medication

Consensus Conference Recommendations

The effective management of asthma requires a dynamic therapeutic approach with collaboration between the health care provider team and the individual with asthma and his/her family. The degree of asthma severity must be assessed on the basis of:

- frequency and severity of symptoms;
- activity limitation;
- degree of airway obstruction; and
- response to medication.

Then, drug therapy must be selected according to the severity of the underlying illness and the most effective medication for the individual. The choice of drugs may change over time as the disease symptoms change.

There are two types of medication to control asthma – controllers and relievers. **Controllers** are taken on a long-term basis and address the inflammation and bronchospasm associated with asthma. **Relievers** are short acting bronchodilators that act quickly to relieve airway constriction and its accompanying acute symptoms such as cough, chest tightness, and wheezing. Most individuals with asthma use relievers and those with more frequent or severe symptoms also use controllers. The Consensus Guidelines provide very detailed directions to physicians regarding which drugs should be used in which situations.

Medications for asthma can be inhaled or given orally or parenterally (subcutaneous, intramuscular or intravenous) depending on the need. Inhaled medication is usually given via a hand held inhaler that must be used properly to ensure that the right dosage is obtained. The health care provider must provide education on its use when it is prescribed. Parenteral medication is used for severe attacks and would normally be given in an emergency department or hospital.

Asthma can usually be managed in the primary care setting by the family physician or pediatrician. Asthma specialists can provide additional assistance for asthma that is difficult to control.

Acute episodes are often treated in the emergency department and may require hospital admission. The Consensus Conference recommended that:

- A structured management plan should be used to treat acute episodes.
- There should be an objective measure of airflow before and after treatment.
- Oxygen saturation should be done before and after treatment.
- Inhaled bronchodilators should be titrated to relieve airway obstruction, and steroid medications should be started early in the acute treatment of asthma.
- A discharge treatment plan and clear instructions for follow-up must be given.

The Consensus Conference reviewed the evidence of the effectiveness of non-pharmacological therapies, such as acupuncture, chiropractic, herbal preparations, homeopathy, naturopathy oligotherapy, osteopathy, and traditional Chinese medicine. There is a lack of research evidence to either support or reject the role of these therapies in the treatment of asthma at this time.

Canadian Situation

The survey of physicians identified some significant differences in the use of drugs for the treatment of asthma compared with the Consensus Recommendations.[43] The most important finding was that 40% of physicians overall considered the regular use of short acting bronchodilators to be "first-line-therapy" for adults and children over the age of six years. The Consensus Recommendations are that these drugs should be used on an "as needed" rather than a regular basis. Regular anti-inflammatory medication is the first choice for preventive, maintenance therapy. While most physicians considered inhaled steroids (anti-inflammatory) to be first line drugs for both adults and children, one-quarter of them did not. These findings suggest that there is room for improvement in the most effective use of medication to control asthma.

A 1992 Canadian survey of emergency room physicians also identified disparities between clinical practice guidelines and self-reported practice.[44] There is room for improvement in the use of objective measures of airflow, higher doses of bronchodilators, the use of anti-inflammatory drugs (corticosteroids), and in appropriate arrangements for discharge and follow-up.

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[43] Ibid.
[44] Grunfeld et al, 547-556.

Education

Consensus Conference Recommendations

The recent Canadian Asthma Consensus Conference sums up the challenge for individuals and families quite succinctly:

> "Asthma is a chronic but variable disease, so patients and their families must be prepared to make lifestyle changes and adhere to drug therapy for long and often asymptomatic periods, as well as being capable of making rapid decisions about symptom severity, self-medication, and the need to seek medical advice. These activities require education."[45]

Research studies report varying success with education programs in terms of increasing knowledge and positive attitudes, treatment compliance, self-management, inhaler technique, lung function, and quality of life.

Education programs should include information about the disease itself, avoidance of triggers, rationale and use of medication, inhaler technique, use of peak flow meter, criteria for control, and steps to take when control deteriorates. The action plan and need for regular follow-up should be discussed. Programs should teach self-management skills for adults and children.

A variety of education approaches should be used, but it is critical that the use of impersonal techniques – pamphlets, videos – be supplemented with individual or group education. Education programs need to use sound education theory and address the predisposing, enabling, and reinforcing factors influencing the adoption of new behaviours[46].

Asthma education needs to be an ongoing process that starts with the diagnosis in the physician's office and continues with each visit to the physician, education session or clinic, emergency room, hospital, and pharmacist. A formal education program through the primary care setting, hospital, clinic, or voluntary association needs to be supplemented with informal discussions at every contact with health care providers.

Health care providers teaching individuals with asthma must have the required knowledge as well as skill to communicate effectively with children and their families and with adults. Asthma educators can fulfil this role effectively.

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[45] Canadian Asthma Consensus Group, S1-S62.
[46] Boulet et al, 184S-196S.

Canadian Situation

Most children and adults are seen in the primary care setting (family physicians, pediatricians) for asthma diagnosis and management. In most cases, these physicians are paid on a fee-for-service basis, limiting how the physicians can practice. Asthma education services are not funded, so the physician must usually provide asthma education him/herself. The effectiveness of the education varies according the knowledge and interest of the care provider.

Some hospitals and community settings have set up asthma clinics with a strong education component provided by a health care professional. Individuals and their families receive education on asthma pathophysiology, asthma medications, environmental control, self-management guidelines and inhaler use. The education sessions are individualized and include both written material and audio-visual presentations. A recent evaluation of one such program found that there was an increased use of inhaled anti-inflammatory medication and decreased use of short acting bronchodilators by those who took part, resulting in a decrease in asthma episodes requiring emergency or hospital care.[47]

The 1997 survey of physicians found that almost all physicians report that they provide some asthma education to all or most individuals with asthma. This was usually information on triggers and how to avoid them, use of medication, use of inhalers, warning signs of worsening symptoms, and when to seek emergency care. Most did not demonstrate the use of a peak flow meter. Education was principally done through discussion. Most did not provide educational pamphlets, brochures, booklets, or videotapes. Very few physicians referred individuals with asthma to a health care professional, asthma centre, hospital, or non-profit asthma agency for education.

There is some consistency between the results of this physician survey and the results of the 1996-97 NPHS Asthma Supplement. Individuals with active asthma (diagnosed by a physician and who were on medication or had symptoms in the past year) were asked whether they had received information on various asthma topics (Figure 11). Most had received information related to medication use (use of inhaler - 87%, correct use of medication - 78%). A lower proportion were given information on managing their asthma (avoiding triggers – 70%, what to do during an attack – 67%, how to live a normal life – 58%, when to go to emergency – 49%). Less than a third (31%) were given information on the proper use of a peak flow meter for assessing the severity of their asthma.

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[47] Dzyngel et al, 291-300.

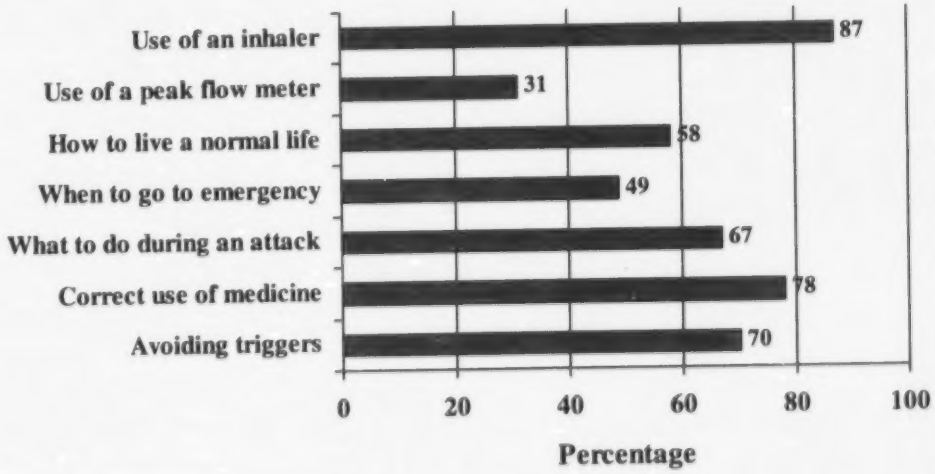
The 1996-97 NPHS Asthma Supplement also asked individuals with active asthma to identify their sources of information (Figure 12). Sources of information included physicians but also included personal research (49% of individuals with asthma), the pharmacist (39%), family (32%), voluntary organization (25%), and friends (20%). The most common physician providing information was the family physician (72%). Medical specialists (46%), emergency room physicians (23%) and walk-in clinics (18%) were also sources of information.

There are some interesting differences in the sources of information for the different age groups of people with active asthma (Figures 13 to 16). Among those under 20 years, 25% received information from a walk-in clinic. For those 20 to 34, the proportion was 18%. Among those aged 35 to 64, a high proportion (61%) have done their own research on asthma.

The wide variety of sources of information used by individuals with asthma is positive, in that there are many opportunities for education; but it also presents a challenge. All health care providers need to be up-to-date on the latest asthma research and recommendations. There must be consistency in the content of the information.

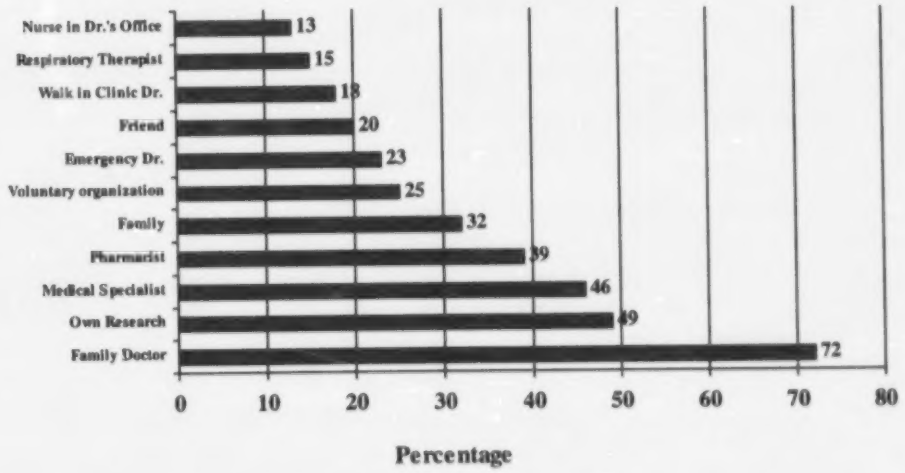
The Canadian Network For Asthma Care (CNAC), a consortium of government, health professional organizations, voluntary organizations, consumer groups, and pharmaceutical companies, has been actively involved in developing guidelines for asthma education, organizing conferences, and providing education and accreditation programs for asthma educators. The challenge is to reach all asthma care providers in the community and hospital setting.

Figure 11 Proportion of individuals diagnosed with active asthma who have ever received information on various topics - ages 2+ years - Canada, 1996-97.



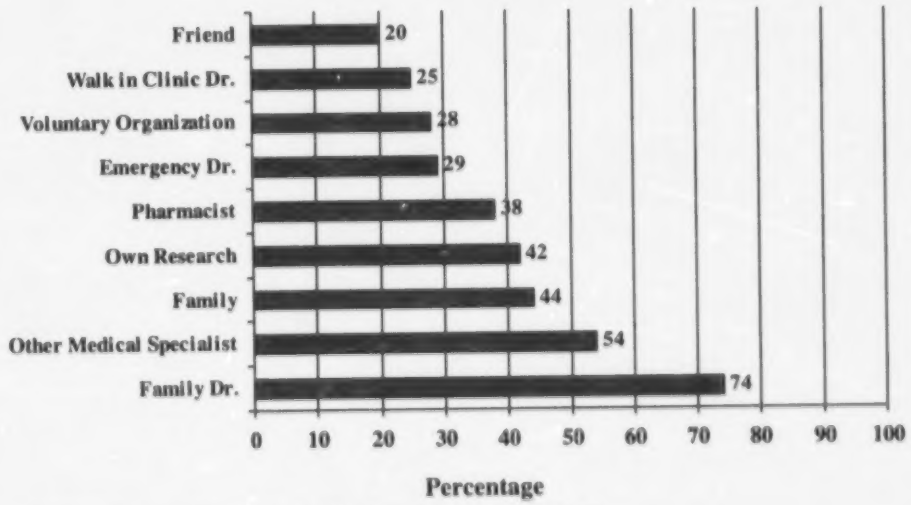
Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*

Figure 12 Proportion of individuals diagnosed with active asthma who have ever received information on asthma from various sources - ages 2+ years - Canada, 1996-97. (Most common sources)



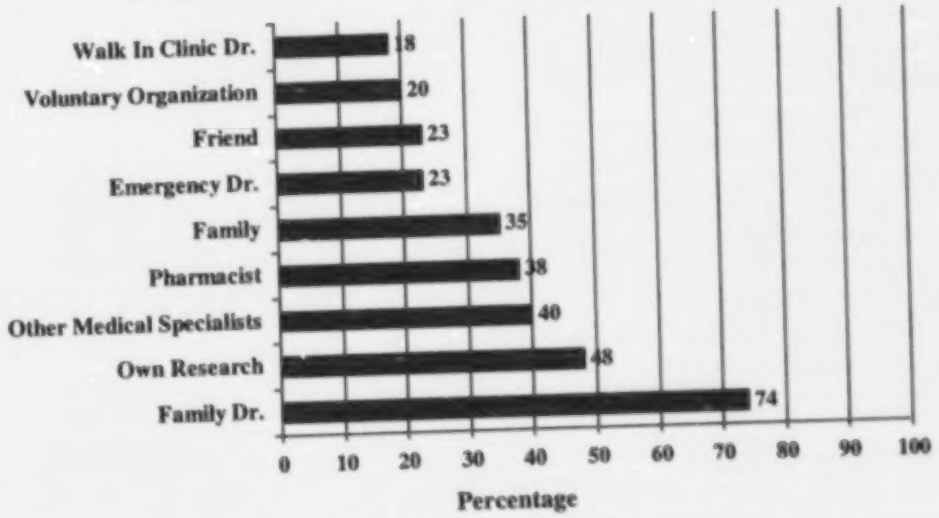
Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*

Figure 13 Proportion of people aged 2-19 diagnosed with active asthma who have ever received information on asthma from specific people - Canada, 1996-97. (Most common sources)



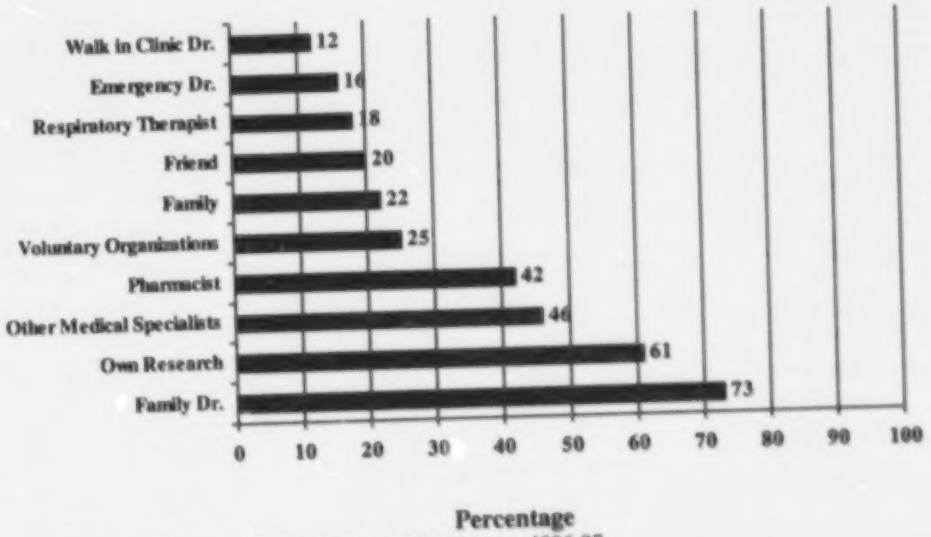
Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*

Figure 14 Proportion of people aged 20-34 diagnosed with active asthma who have ever received information on asthma from specific people - Canada, 1996-97. (Most common sources)



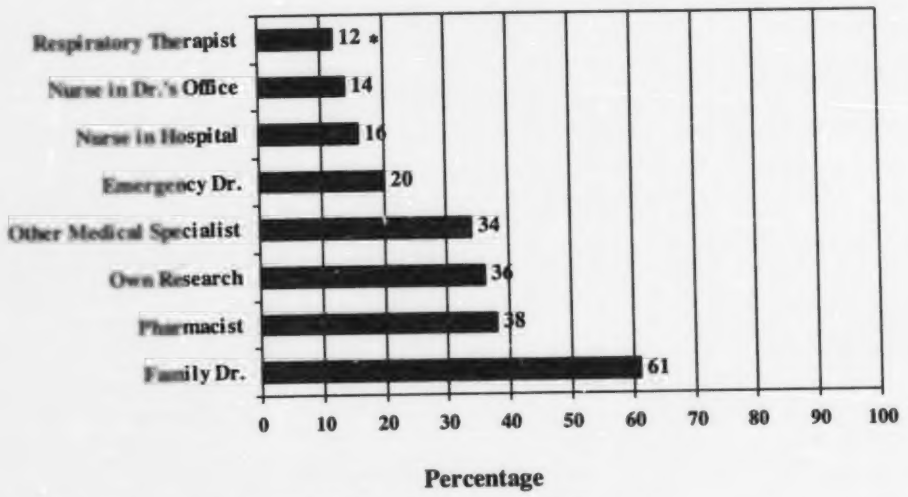
Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*

Figure 15 Proportion of individuals aged 35-64 diagnosed with active asthma who have ever received information on asthma from specific people - Canada, 1996-97. (Most common sources)



Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*

Figure 16 Proportion of individuals aged 65 and over diagnosed with active asthma who have ever received information on asthma from specific people - Canada, 1996-97. (Most common sources)



Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*
* *high sampling variability*

Monitoring and Follow-up

Consensus Conference Recommendations

Monitoring and follow-up of individuals with asthma is done both in the office and home settings. The purpose of monitoring is the early identification of changes in asthma symptoms so that adjustments can be made to medication or exposure to allergens to avoid severe asthma episodes. Follow-up in the clinical setting allows for a formal assessment of how well the management plan is working and any adjustments that are needed. Spirometry can be used to assess the degree of airflow obstruction, but one measure can be normal even if there is poor control, so it is important to get the full history of symptoms over time. This can be done through a diary completed by the individual with asthma.

Research studies have found that individuals with asthma are able to control their asthma and avoid visits to acute care facilities by monitoring their disease severity and modifying their therapy on the basis of a written plan.[48] Monitoring can be done through an assessment of symptoms or by using peak flow monitoring (PFM). Most

[48] Canadian Asthma Consensus Group, S1-S62.

studies have shown that either is effective. PFM devices must be checked regularly for accuracy and reliability, and the individual with asthma must be taught how to use them properly.

The Consensus Conference recommended that:

- All individuals with asthma should do self-monitoring via measurement of peak expiratory flow or monitoring of asthma symptoms as desired by the individual.
- Monitoring peak expiratory flow may be useful in selected individuals, particularly those who are poor perceivers of airflow obstruction.
- Monitoring of pulmonary function in physicians' offices should be routine.
- Individuals with severe or poorly controlled asthma should be referred to an asthma expert.
- Individuals with asthma should be given action plans.

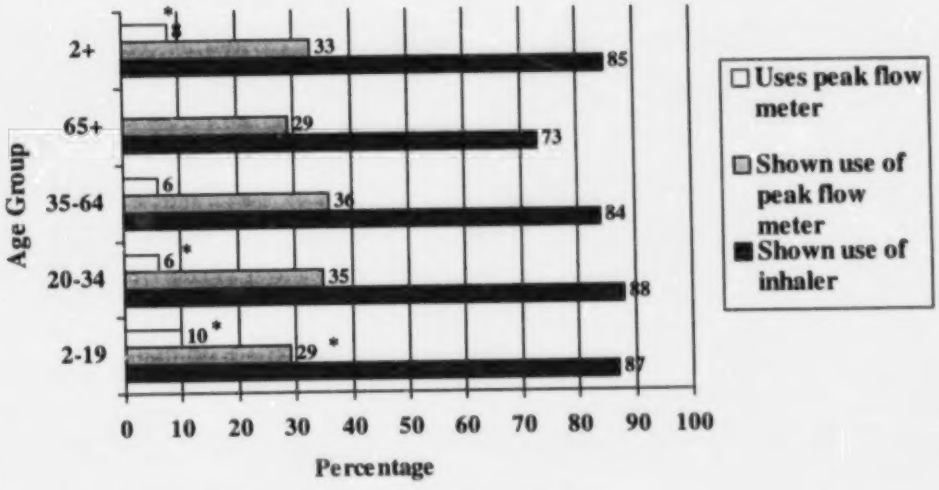
Canadian Situation

Adherence to action plans varies. Many individuals with asthma (up to two-thirds) are reluctant to increase the dose of drugs or make self-management decisions when asthma symptoms worsen.[49] It is also a challenge to have individuals with asthma keep regular records of their symptoms. Intensive education and follow-up programs are needed.

One-third (33%) of individuals with active asthma have been shown the use of a peak flow meter according to the 1996-97 NPHS Asthma Supplement (Figure 17). Only 8% of the individuals with asthma were using a peak flow meter themselves. Only slightly over one-third of physicians (38%) in the Physician Asthma Management Survey said that they demonstrated the use of the peak flow meter. This suggests that many physicians are not using this technique in their offices or home settings to monitor asthma.

[49] Ibid

Figure 17 [illegible] have been given skills training by age group, Canada, 1996-97.



Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*
**high sampling variability*

Avoidance of Triggers

Consensus Conference Recommendations

Exposure to allergens can result in a worsening of asthma symptoms, an acute asthma attack, or even death. It is very important, therefore, that the asthma management plan includes the control of asthma triggers. Asthma symptoms, objective measurements of airflow obstruction, as well as airway hyper-responsiveness improve when the individual avoids environmental allergens to which he/she is allergic.

The Consensus Conference recommended that:

- Allergens should be identified and a systematic program should be undertaken to eliminate, or at least substantially reduce, such allergen exposures.
- Increasing medication use should not be a substitute for avoidance of exposure to allergens and irritants.

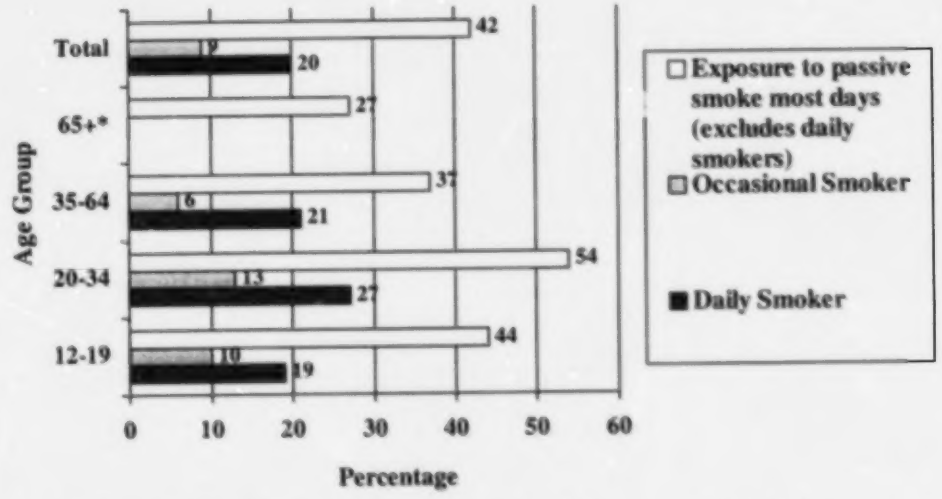
Canadian Situation

The avoidance of some allergens can be done through individual and family household measures such as using special mattress covers, pillow and comforter casings, washing linen in hot water, keeping humidity below 50%, and removing carpets and pets to which the individual is allergic. Studies have found that there is poor compliance with these recommendations unless they are part of a formal education program.[50] This reinforces the need for a comprehensive asthma education program that uses a variety of approaches.

In many situations, individuals with asthma do not have control over the air they breathe, including:

- outdoor air pollution caused by cars and industry – particulates, ground level ozone, acid aerosol, sulphur dioxide, and nitrogen dioxide;
- workplace environment – passive smoke, scents and noxious odours, workplace chemicals;
- daycare and school environment - scents and noxious odours, other chemicals, food (for example, peanuts), fungi; and
- tobacco smoke in public places.

Figure 18 Proportion of individuals diagnosed with active asthma who were exposed to tobacco smoke - by age group - Canada, 1996-97.



Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.* * *too small*

[50] Schellenberg et al.

According to the NPHS Asthma Supplement, 42% of individuals with active asthma are exposed to passive smoke most days (Figure 18). The community as a whole needs to become involved, therefore, in the reduction of smoke and other allergens in the air. This will require increasing the level of awareness in the general public about the danger of environmental tobacco smoke (ETS) and the need for legislation and policy changes.

Management Plan

Consensus Conference Recommendations

Asthma is a chronic condition that can have a very negative impact on the quality of an individual's life. This can be minimized if the individual and family have a personalized asthma management plan. A management plan should include the following components:

- use of medication – controllers and relievers;
- regular follow-up with physician or asthma clinic;
- monitoring of symptoms at home;
- education plan – what, how and when;
- action plan - what to do if symptoms worsen and when to seek medical care;
- avoidance of asthma triggers;
- education of individuals in childcare or children's recreational settings (groups, daycare, school, camp); and
- promotion of healthy lifestyle – nutrition, regular exercise, relaxation, stress management.

The development of such a plan is the ideal way to involve individuals (and families of children) in the active management of their asthma. They can identify the particular challenges present in their lives and work with the health care provider to plan effective responses. The development of the plan can also form the basis for the asthma education program. A review of the plan at each visit can provide an opportunity for ongoing education.

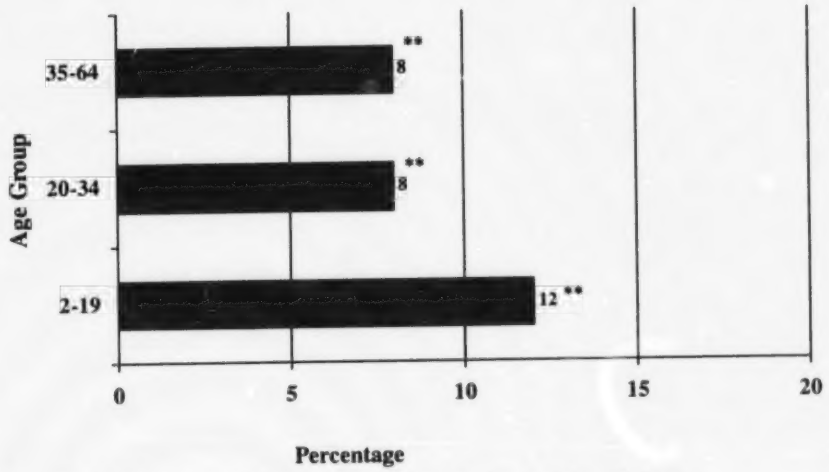
The Consensus Conference recommended that:

- A written action plan for guided self-management, usually based on symptoms, must be provided for all patients.

Canadian Situation

According to the 1996-97 NPHS Asthma Supplement, only a small proportion of individuals with active asthma (10%) had been given a personalized guided self-management plan by their asthma care provider. The younger age groups were more likely to have been given a plan (Figure 19). This finding is consistent with the 1997 survey of physicians: only 17% said they developed a written asthma action plan with all or most individuals with asthma. Paediatricians (48%), respirologists (37%), and immunologists (33%) were much more likely than family physicians (14%) or internists (18%) to use action plans.

Figure 19 Proportion of individuals diagnosed with active asthma who have ever been given a personal asthma self-management plan[1] - by age - Canada, 1996-97.



[1] Plan tells how to adjust medication based on severity and when to seek medical care.

Source: *Statistics Canada; NPHS Asthma Supplement, 1996-97.*
*** high sampling variability*

Immunotherapy

Consensus Conference Recommendations

Immunotherapy is a process of de-sensitizing an individual to an allergen through repeated careful titrated doses of the allergen given subcutaneously. It is used successfully to treat allergic rhinitis and conjunctivitis. Research studies suggest that allergen immunotherapy is effective in the treatment of asthma, leading to fewer symptoms, decreased medication requirements, and decreased airway hyper-responsiveness.[51] However, there is also a risk of severe allergic reaction, including death.

The Consensus Conference recommended that:

- Immunotherapy should be restricted to individuals in whom a very specific allergen is identified and exposure to this allergen cannot be avoided.
- Immunotherapy should not replace the avoidance of environmental allergens.
- Immunotherapy should be administered only by trained personnel in centres with medical supervision and resuscitative equipment.

Summary

A review of the Canadian Asthma Consensus Conference recommendations and the present Canadian situation has identified the following areas that could be improved to enhance asthma control in Canada:

- increased knowledge among physicians about clinical practice guidelines;
- increased use of long-term inhaled anti-inflammatory controller medication to decrease the over-reliance on reliever medication;
- increased use of objective measures of airflow for the diagnosis and serial monitoring of asthma control;
- increased use of written, personalized asthma plans for guided self-management;
- enhanced health services to ensure that individuals newly diagnosed with asthma and their families have access to appropriate education for asthma management. This includes adequate funding and increasing the number of and access to appropriately trained and certified asthma educators;
- reduction in environmental contaminants (aeroallergens, moulds, tobacco smoke, vehicle and industry emissions, noxious odours, and scents) that can trigger asthma episodes and symptoms in the home, workplace, childcare setting, and schools.
- support to some families that do not have sufficient financial resources to purchase medication and devices (spacers, holding devices, mattress enclosures, and peak flow meters) for effective asthma management.

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[51] Ibid.

System Support

Many organizations, health care providers, and community groups in both the health and non-health sectors can be involved in the prevention and control of asthma. To be truly effective, their efforts must be coordinated as part of an overall system. It is vital that the support needed by these groups and individuals be in place in order to create this system and ensure their effectiveness within it.

For such a system to be effective, it needs:

- **collaborative planning, evaluation, and communication** to ensure that the system functions effectively in the most efficient way, and to create a communication mechanism among its parts;
- **surveillance** to detect and monitor internal or external factors that have an impact on any component, or on the system as a whole, and to disseminate this information to decision-makers in a timely fashion;
- **research and evaluation** and its dissemination to managers and clinicians to support evidence-based decision-making; and
- **ongoing education** of health care providers.

Collaborative Planning, Evaluation, and Communication

Coordinating mechanisms provide a vehicle for organizations, health care providers, and groups to plan their work together. They help to concentrate resources so that they will have the most impact, while avoiding duplication and ensuring continuity in service. They also provide a mechanism for involvement of the community itself in identifying needs and implementing solutions.

Coordinating mechanisms are needed at all three levels of decision-making – national, provincial/territorial, and local/regional. The National Asthma Control Task Force (NACTF), a consortium of professional, voluntary, and government organizations, could fulfil this function at the national level. The purpose of this national coordinating body would be to:

- review surveillance information on asthma to identify the need for, and impact of, strategies;
- make recommendations on national policy;
- coordinate national strategies among national organizations; and
- develop and disseminate clinical practice guidelines.

At the present time the NACTF's activities are funded by the Laboratory Centre for Disease Control, Health Canada.

Surveillance

> "Public health surveillance is the ongoing, systematic collection, analysis and interpretation of health data in the process of describing and monitoring a health event closely integrated with timely dissemination of information to those who need to know. This information is used for planning, implementing and evaluating public health interventions and programs. Surveillance data are used to determine the need for public health action and to assess the effectiveness of programs".[52]

Surveillance is a critical component of any support system for a health problem. It allows participants to monitor whether the population's identified health goals are being met or whether changes in programs or policies are needed. It is the only way to assess the effectiveness of policy changes or social marketing programs that are targeted to the population as a whole.

The principles of a good surveillance system are:[53]

- simplicity in both structure and ease of operation;
- flexibility for adapting to changing information needs or operating costs (time, personnel, or allocated funds);
- acceptability to individuals and organizations who participate in the system;
- high sensitivity in the proportion of events detected by the system;
- high positive predictive value (the proportion of the individuals identified as being a case who actually have the condition);
- representativeness (accurate description of the occurrence of the event over time, and its distribution in the population by place and person);
- timeliness (minimal delay between steps in the surveillance system).

The key elements of a surveillance system are:

- population and health events framework that identifies what data are to be collected on which population groups;
- data collection or collation though a variety of sources;
- data analysis;
- reports and interpretation to transform the data into information;
- information dissemination to ensure that managers and policy makers are aware of population measures of asthma prevention and control; and
- use of the information in the development of policies, programs, and services.

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[52] United States Department of Health and Human Services: Centers for Disease Control and Prevention. Guidelines for Evaluating Surveillance Systems.

[53] Ibid.

The surveillance system, as it exists at the present time, is very limited. The National Population Health Survey provides information on the prevalence of self-reported physician-diagnosed asthma every two years at the national and provincial levels. It takes up to 18 months for these data to be available to planners. While this is useful information, the survey lacks timeliness and does not collect information on asthma symptoms. The new Canadian Community Health Survey will provide more timely data at the local health region level and may provide data on physical measures, such as lung function.

Data regarding morbidity and mortality are available in hospital reports and the mortality database. However, the national hospital separation statistics would be improved if they were person-specific rather than simply summaries of separations. In addition, it would be useful to have the data from various administrative databases linked to create a longitudinal assessment of the use of services by an individual with asthma.

The surveys of physicians and of children in sentinel health units, along with the special asthma supplement to the NPHS, have contributed to the development of a methodology that could be used to monitor asthma prevention and management in the population.

Research and Evaluation

Research and the evaluation of programs provide essential evidence to ensure that resources are used effectively and efficiently, and that clinical decisions will help the individual. Therefore, a strong link must be created between researchers and clinicians, managers, and policy makers.

While there is considerable ongoing research on the effectiveness of drugs to treat asthma, there is a lack of research on the effectiveness of other aspects of the control program, such as prevention, education, self-management prevention programs, and health services research. There are fewer sources of funding for these research areas. More networking and linking of databases would facilitate better use of existing data.

Ongoing Education of Care Providers

The current knowledge base is constantly expanding. A mechanism that will help clinicians keep up to date with the most recent knowledge is vital. Professional societies and coalitions have taken the lead in reviewing the research literature and developing clinical practice guidelines so that clinicians can make evidence-based decisions. These guidelines need to be expanded to include all health care providers in addition to physicians. They also need to include advice on implementing the guidelines in practice.

Physicians and other health care providers are in varying stages of readiness for adopting new recommendations for practice. Research suggests that the publication of clinical practice guidelines (CPGs) alone is not enough to have an impact on physician behaviour. Some of the factors that will influence whether an innovation will be adopted are:[54]

- evidence from the scientific literature;
- expression of support for change from an expert or authority in the field;
- peer validation from opinion leaders;
- ease of implementation;
- presence of enabling factors; and
- reinforcing factors – positive feedback.

If interventions are to be successful, they must:

- be multi-pronged;
- be individually tailored to the stage of readiness of providers;
- address predisposing, enabling, and reinforcing elements; and
- combine "experts", peers, and the literature.

A detailed dissemination strategy for the recently released Asthma Practice Guidelines has been developed, and funding is being sought to implement it to ensure that all health care providers are aware of, and use, the guidelines.

The Canadian Medical Association has made the following recommendations for the implementation of clinical practice guidelines:[55]

- build a healthy process from the start by involving service providers, who will be the end users, in the development of the guidelines;
- carry out a needs assessment;
- use multiple interventions at the local level;
- build on existing structures;
- build in mutual support mechanisms;
- include evaluation to guide the process;
- involve the public; and
- recognize that CPGs are an evolving technology and develop a system to modify them as necessary and build this change into the system.

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[54] Davis et al, 1111-1117.
[55] Canadian Medical Association.

Effective asthma management will depend on health care providers educating their clients about asthma. The Canadian Network for Asthma Care (CNAC) has developed national learning objectives and a Pre-study Module for asthma educator programs and asthma educators. CNAC-approved asthma educator programs should be further promoted and the availability of the CNAC Pre-study Module manual further publicized to asthma health care providers.

Summary

The prevention and management of asthma is a complex undertaking involving many health care providers, organizations, and groups. It is important that consideration be given to the kind of support the system requires to enable it to function effectively in response to the needs of the population. Strategies could include:

- developing and providing support for new and existing coalitions or networks at the local, provincial/territorial, and national levels to facilitate joint planning and collaboration;
- developing an ongoing surveillance system to assess
  - mortality;
  - quality of life;
  - morbidity;
  - use of health services;
  - drug use; and
  - prevalence of asthma and asthma symptoms;
- enhancing research support for all aspects of the prevention and control of asthma; and
- developing an ongoing process for the continuing education of health care providers starting in professional schools.

Summary

Asthma is a common health problem in Canada affecting about 6% of adults and about 12% of children and teens. There has been an increase from the 1970s in the prevalence of asthma among children due to a variety of factors. The challenge is to identify what can be done to prevent and manage it more effectively.

There is a lack of research on the effectiveness of interventions to prevent the onset of asthma. On the basis of the epidemiological evidence, it is likely that the following strategies will contribute to a reduction in the incidence of asthma. These strategies require the combined efforts of many individuals, organizations, community groups, and government. Strategies need to be directed at:

- reducing exposure in the workplace to airborne contaminants;
- reducing exposure to passive smoke, both *in utero* and among young children;
- encouraging breastfeeding and delayed introduction of solid foods;
- decreasing the exposure of young children to house dust mites, cockroaches, and moulds through regular cleaning and adequate ventilation; and
- decreasing the exposure of children with genetic predisposition to asthma to known sensitizers.

The Canadian Asthma Consensus Conference has produced clinical practice guidelines for the effective management of asthma based on existing research. Recent Canadian studies suggest that there is a gap between what the guidelines say should be done and what is actually in all areas of the guidelines. This is a function of knowledge about the guidelines, but also a reflection of the way health services are organized and funded.

At a systems level, the asthma surveillance system is very basic and needs to be expanded to provide meaningful information to policy makers. A formal, on-going process is needed for education of service providers. Improved collaboration is needed at the national, provincial/territorial and regional/local levels to ensure continuity of care, effective planning, and to optimize the various components of the health care system.

A National Asthma Prevention and Management Strategy can provide the overall framework needed to mobilize energies from many sectors to the prevention and management of asthma in Canada. This background document is being used by the National Asthma Control Task Force to develop the national strategy.

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